

Preliminary analysis of wind data from South Channel Island

Introduction

Many people expressed concern that deepening the shipping channel a further 5 metres at the Entrance to Port Phillip Bay would permanently alter the hydrodynamics of the Bay and (among other things) cause coastal erosion. Submissions stating these concerns to the Independent Planning Panel which assessed the Supplementary Environment Effects Study were ignored on the basis of 'expert advice' in the Channel Deepening Project (CDP) Supplementary Environmental Effects Study¹ which concluded:

“Dredging will have a very small impact, less than 0.01 m, on tidal water levels in Port Phillip Bay.” and “Sea level change, including astronomical tide and storm surge, due to dredging will be small with low water being about 10 mm lower and 6 mm higher at high water.”

However, there have been reports of unprecedented high tides, inundation of beaches, land and roads, a marked increase in swell and significant erosion of beaches over the past twelve months, particularly in the south of the bay and especially at Portsea.

The Office of Environmental Monitor (OEM) is reported² as saying that there is no evidence to suggest that dredging is to blame for erosion at Portsea beach; and that the most likely explanation was natural erosion caused by the local impact of storms and seasonally high tides, exacerbated by the swell rolling in from Bass Strait. In the same article the OEM is reported as saying that although the range between the low and high tide marks has increased by 20mm for short periods (since dredging), the average tide has stayed the same.

Purpose

This paper provides a preliminary analysis of wind data from South Channel Island and observations of local people on changes seen to have occurred since dredging at the Entrance in order to examine potential causes of erosion at Portsea.

In the absence of data to measure long distance storm surges and tidal current strength, this analysis investigates wind direction and strength in the south of Port Phillip Bay since the beginning of September 2008³; and compares data from that period with previous years in order to determine if wind-driven waves would be the dominant factor in the recent erosion.

¹ SEES Appendix 45 Cardno Lawson & Treloar, 2007b.

² The Age, 5/5/10 Life's not so swell at Portsea

³ Dredging at the Entrance is reported to have concluded in mid September 2008.

Summary

Various sources⁴ suggest that erosion at Portsea beach has accelerated since completion of dredging at the Entrance. The Office of Environmental Monitor is reported as attributing “seasonal storms” as the cause of this erosion; and that dredging is not the cause.

Preliminary analysis of wind data from South Channel Island indicates that although the overall frequency of >40km/hr winds in the region of Portsea and Point Nepean was high during the post 2008 period, it was no greater than in 2002.

This preliminary wind analysis suggests the region experienced greater ‘erosional’ wind frequencies during the period from 2000-2002 than in the 2007-09 period. However, relatively little beach erosion was observed during the 2000 – 02 period⁵ with Portsea beach reported to be in similar condition as it was in 2001. This further suggests Portsea erosion over the past 12 months is unlikely to have been primarily caused by storm events.

However, a higher incidence of strong Westerly winds did occur in the first half of 2010 than in any other year and more specific data is required before firm conclusions are possible. As yet, the OEM has not provided detailed analysis of the seasonal storms in the south of the Bay.

Wind data received from the National Climate Centre did not go beyond describing winds beyond >40km/hr. In applying the Bureau of Meteorology definitions of wind strength, a 40km/hr wind is not even considered to be a ‘strong wind’. Consequently, further information is being sought from the National Climate Centre to identify individual wind events and specific speeds > than 40km/hr at South Channel island.

In conjunction with tidal analysis⁶ which shows average daily highest tides at Hovell Pile have increased by 51mm and average monthly highest tide has increased 133mm since dredging at the Entrance was completed, this analysis presents a reasonable basis to conclude that studies used to date to inform the OEM are inadequate and/or should be reviewed.

The Baykeeper Tidal Analysis also found that there is considerable variation in levels across the PPB sites, ‘generalised’ statements referring to a single average tidal level in PPB do not represent the reality of localised sites in the Bay.

Similarly, generalized comments by the OEM in relation to seasonal storms without reference to specific detail suggests that available studies are inadequate for the purpose of reaching a firm conclusion that channel deepening has not significantly contributed to erosion at Portsea.

⁴ Mornington Peninsula Leader 10/5/10

⁵ Review of Beach Renourishment Priorities Report for Port Phillip Bay, GHD April 2008 reported Portsea beach to be in similar condition as it was in 2001.

⁶ Analysis of Port Phillip Bay Tides Jan 2000 – Dec 2009. Port Phillip Baykeeper. May 2010

Methods

All available wind data from South Channel Island was received from the National Climate Centre on 17/6/10. As this station is approximately 8 km East North East of Portsea, the data is unquestionably relevant to Portsea and the south of the Bay in general.



Figure 1: Port Phillip Bay weather station locations

For the purpose of this analysis:

- Wind directions considered to directly contribute to beach erosion on Mornington Peninsula are Westerly, North Westerly, North and North Easterly. *Note: NE winds are included for the sake of thorough analysis, although they are unlikely to cause erosion due to limited 'fetch' across water. Winds from the South West, South, South East, and East would not cause wave attack on the beach and are therefore excluded from this analysis.*
- Wind strength definitions from the Bureau of Meteorology are adopted (see Appendix 1.)
- Wind strengths which are likely to cause erosion are those that are >40km/hr.

Various sources of information on coastal erosion are referenced, including newspaper reporting, state government beach renourishment studies, and personal communications from local people with long-standing experience in the marine environment in the south of the bay.

Analysis of South Channel Island wind data

Table 1 shows seasonal percentage frequencies of winds exceeding 40km/hr. Figures in each 'direction' column are records for Autumn, Winter, Spring and Summer in that order.

The 'TOTAL' row represents the wind frequency total from each direction. Note only 2 seasons have been recorded in 2010 at the time of preparing this table. The 'ALL' column represents the total sum of wind frequencies for each year, and provides an indicator which can be used to compare winds in each year⁷.

Table 1. Seasonal percentage frequencies > than 40km/hr winds, 2000 – 2010

	N	NE	W	NW	ALL
2000	5,8,3,4 (20)	0,0,0,0 (0)	3,2,8,0 (13)	0,0,5,0 (5)	38
2001	4,6,3,1 (14)	0,0,0,0 (0)	2,5,4,3 (14)	1,2,2,1 (6)	34
2002	4,14,3,2 (23)	0,0,0,0 (0)	1,10,7,0 (18)	2,4,1,1 (8)	49
2003	2,10,2,2 (16)	0,0,0,0 (0)	1,3,3,1 (8)	0,4,3,0 (7)	31
2004	2,9,3,2 (16)	0,0,0,0 (0)	2,3,1,1 (7)	2,2,1,0 (5)	28
2005	2,10,3,2 (17)	0,0,1,0 (1)	1,4,3,0 (8)	0,1,0,0 (1)	27
2006	2,5,3,2 (12)	0,0,1,0 (1)	3,2,6,2 (13)	1,1,0,2 (4)	30
2007	7,7,2,0 (16)	0,0,0,0 (0)	3,2,6,2 (13)	3,2,2,0 (7)	36
2008	3,2,4,0 (9)	0,0,1,0 (1)	2,6,3,3 (14)	2,2,1,1 (6)	30
2009	4,16,6,2 (28)	0,0,0,0 (0)	4,4,3,2 (13)	3,4,1,0 (8)	49
2010	1,0 (1)	0,0 (0)	5,6 (11)	1,3 (4)	16
TOTAL	172	3	132	61	368

Discussion of Table 1

Of all years recorded, 2002 and 2009 have equal highest total of > 40km/hr winds. When >40km/hr totals for each of the above years are combined with of the two preceding years, the total for 2002 is 121; and the total for 2009 is 115. This provides a preliminary indication that a greater frequency of 'erosional' winds occurred in 2000-2002 than in 2007-09.

A higher incidence of northerly winds > 40 km/hr occurred in 2009; whereas there was a greater frequency of >40km/hr westerly winds in 2002. However, it should be noted that there has been a higher incidence of Westerly winds during Autumn and Winter 2010 (percentage frequencies of 5 and 6 respectively).

These winds would contribute to, and exacerbate the westerly swell which has been observed coming from the Heads on the incoming tide. The combination of westerly winds and swell with King Tides which occur in April would present optimum conditions for beach erosion.

⁷ Figures in the 'ALL' column do not represent percentage frequencies for the year. The figure simply provides a gauge of relative windiness for any given year.

Other reports and communications

The Bureau of Meteorology at Latrobe St. Tel: (03) 9669 4000 (4943) reported gale force winds occurred on 28 April 2010, coinciding with a full moon. Wind measured at South Channel Fort was as follows:

Wed 28th Apr – NW at 50 -55kmh gusting to 65 kmh (gale force) Thurs 29th Apr WNW till midday at 35kmh then SW35kmh then W 35kmh declining as it swung to east.

Subsequent reports from a range of sources suggest that the event referred to above clearly caused notable erosion at Portsea. For example, a Marine Researcher emailed Baykeeper on May 1, 2010:

- “I dived at Portsea last night and I must say I was shocked by the state of the beach. The tide had only just started coming back in and already the concrete steps at the base of the pier were in the water. (It used to be that you had to walk up several metres of sand to reach these steps). The beach immediately west of the pier looked like it would be completely inundated at high tide; I have not seen this phenomenon in over 25 years of going there.”

An article in the Mornington Peninsula Leader of May 10 reported:

- **Mornington Peninsula Cr Tim Rogers:** described the situation as a debacle and said the response of authorities had been woeful. “The change (to the beach) in the past 12 months has been unbelievable,”
- **Portsea Hotel proprietor Andrew Henderson:** said he feared the beach would be completely ruined unless urgent action was taken. Sand 2.5m deep had been eroded, destroying the beach. “To suggest it is due to seasonal storms is absolute garbage,”
- **Regular Portsea diver Sue Peatling:** said Portsea Pier had provided one of the best dive sites in the bay, but not any more. “Now the surge that rips through there makes you feel like you’re in a washing machine,” “I have been diving in the bay for over 20 years and have never seen Portsea like it is now.”

The above comments from locals strongly indicate that erosion has not been simply due to a one-off storm. This view was supported by the observations of a **Local Dive Operator** in a phone conversation on 26/6/10.

- “Swell from the Heads changed after the top was knocked off ‘the Plateau’ about 14 months ago (April 2009?). The Plateau is just inside the Entrance, north of the Canyon. The swell rolls in on the incoming tide - used to follow the South Channel but now heads towards Portsea.”

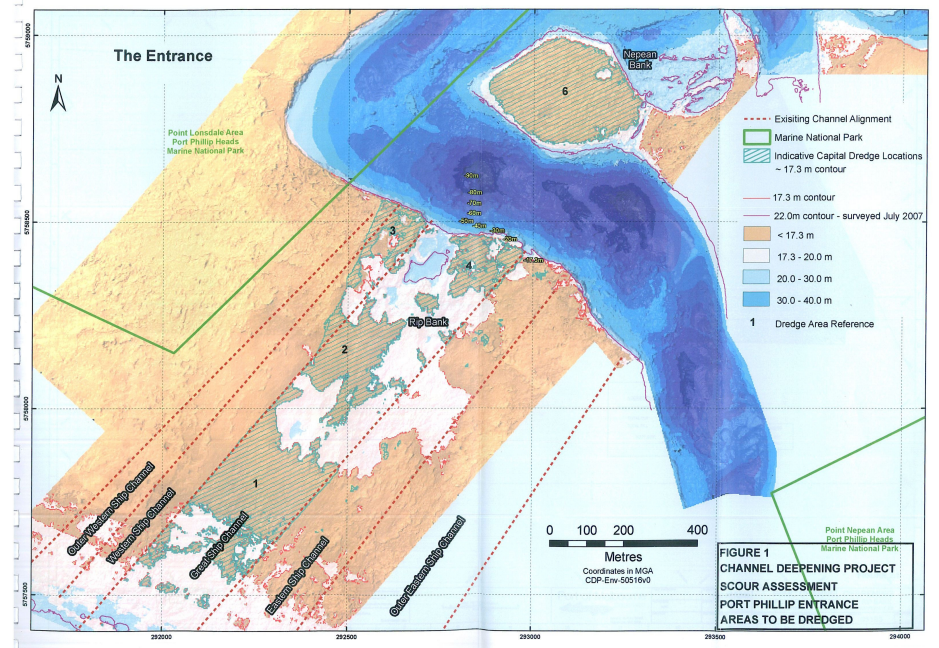


Figure 2: Chart from PoMC Scour Assessment report (July 2007).

The area known as ‘the Plateau’ is the green-hatched, oval area (6), part of Nepean Bank on the top right of the chart.

Analysis of Port Phillip Bay Tides Jan 2000 – Dec 2009

Port Phillip Baykeeper conducted an analysis of tidal levels from stations in Port Phillip Bay and Lorne for the period 2000- 2009. This study found that Average daily highest tides (post deepening of the Entrance) varied from station to station, but those in the south of the Bay were significantly higher than the north. The analysis concluded that *a marked increase in Average Monthly Highest Tide can be attributed to extreme weather events, whereas Average Daily Highest Tide are more representative of the basic (non-weather related) tidal regime.*

Average daily highest tides at Hovell Pile were found to be 51mm higher than before deepening of the Entrance and the average monthly highest tide increased by 133mm.

Recommendations

Observations of increased high and low tides, increased swells and speed of currents, change in direction of currents, beach inundation and erosion since the channel deepening project raise serious concerns about the changes to the hydrodynamics of Port Phillip bay since channel deepening. The state government and OEM have recently agreed to extend monitoring of tidal data, however, little attention is being paid to the changes in swells and currents. In addition to conducting further tidal analysis, research into what is happening to swells and currents in the south of the Bay over several years is warranted.

Further information should be obtained from the National Climate Centre to identify individual wind events and specific speeds > than 40km/hr at South Channel island.

Appendix 1: Definitions and terminology

Wind speed is the **average** speed of the wind over a 10-minute period at a height of 10 metres above the surface. As a guide, double the wind speed in knots to convert to kilometres per hour; for example 20 knots is approximately 40 km/h.

Gusts are increases in wind speed lasting for just a few seconds. The speeds are typically 30 to 40 per cent higher than the average wind speed, but stronger gusts are likely in the vicinity of showers, thunderstorms and frontal systems.

A **squall** is an abrupt and large increase in wind speed with a duration of the order of minutes and which diminishes rather suddenly.

Strong wind warning: 26 to 33 knots. **Gale warning:** 34 to 47 knots. **Storm force wind warning:** 48 to 63 knots. **Hurricane force wind warning:** 64 knots or more.

Wind direction is given in 8 compass points for forecasts and 16 for observations and is the direction the wind is coming from.

Sea (or wind) waves are generated by the local prevailing wind and vary in size according to the length of time a particular wind has been blowing, the fetch (distance the wind has blown over the sea) and the water depth.

Swell waves are the regular longer period waves generated by distant weather systems. There may be several sets of swell waves travelling in different directions, causing a confused sea state.

Bibliography

Analysis of Port Phillip Bay Tides Jan 2000 – Dec 2009. Port Phillip Baykeeper. May 2010.

Port of Melbourne Corporation Channel Deepening Project Scour Assessment report The Entrance. Sinclair Knight Merz, July 2007.

Review of Beach Renourishment Priorities for Port Phillip Bay. GHD April 2008